

Empirical Formulae

The method used on Page 44 uses the % of an element in a compound — but the same method can be used if the mass of an element is given. Here's an example:

Calculate the empirical formula of a compound made by combining 1.92g of magnesium with 5.68g of chlorine.

Magnesium		Chlorine
Mass (g)	= 1.92	= 5.68
Molar mass (g)	= 24	= 35.5
Divide by A_r for each element	= $\frac{1.92}{24} = 0.08$	= $\frac{5.68}{35.5} = 0.16$
$\frac{\text{Amount}}{\text{Smallest amount}}$	= $\frac{0.08}{0.08} = 1$	= $\frac{0.16}{0.08} = 2$
Ratio of amounts	= 1	: 2
MgCl_2 or, better,		MgCl_2

Use the example to help you answer these two-element questions:

- Q1** 2.70g of aluminium is combined with 10.65g of chlorine. What is the empirical formula of the new compound?
- Q2** 1.68g of iron is combined with 0.48g of oxygen. What is the empirical formula of the new compound?
- Q3** 1.6g of sulphur was heated in oxygen. Its mass increased to 4.0g. What is the name of this oxide of sulphur? Show how you found this out by calculating its empirical formula.
- Q4** 190.5g of copper reacts with 48g of oxygen. Calculate the empirical formula.
- Q5** A sample of lead chloride was found to contain 82.8g of lead and 28.4g of chlorine. What is its empirical formula?
- Q6** 0.48g of magnesium is heated strongly in a crucible until it had completely reacted with the oxygen in the air. The mass of the new compound was found to be 0.80g.
- Name the new compound.
 - Calculate the mass of oxygen that has been added to the magnesium.
 - Calculate the empirical formula.

Use the example to help you answer these two-element questions:

- Q7** 1.48g of a calcium compound contains 0.8g of calcium, 0.64g of oxygen and 0.04g of hydrogen. Calculate the empirical formula and name the compound.
- Q8** Copper sulphate crystals contain water of crystallisation (water in its crystal structure) and have the formula $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$, where x is a number. 49.9g of a sample of copper sulphate was found to have 18g of water of crystallisation. Calculate x.

Top Tips:

Empirical formulae are not the same thing as real (molecular) formulae — you've got to cancel those numbers. So, ethene's molecular formula is C_2H_4 , but its empirical formula is CH_2 — you're writing the ratio of the numbers of moles in its simplest form.